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Title: Antishear Bell and Spigot Joint Mechanism

ABSTRACT

In an antishear bell and spigot joint mechanism for socket pipes (1) the spigot end (3) of the one pipe is adapted for insertion with a radial play into a bell end (2) of the other pipe, which includes a joint gasket (8). Associated thereto is clamping ring (14), which is separated from the joint gasket and comprises a plurality of clamping segments (15). These clamping segments are interconnected in the circumferential direction by molded-on intermediate layers of rubber or the like. Each clamping segment comprises on its inner side a toothing that cooperates with the spigot end. To be able to use the mechanism also for socket pipes with a bell end of a comparatively simple configuration for producing a bell and spigot joint, the bell end (2) comprises for receiving the joint gasket (8) an axially open sealing chamber (7) that is formed by radially widening the diameter of the inside socket wall. Associated to the bell end (2) is a restraining ring (9), which is used for securing the clamping ring (14) and for compressing the joint gasket (8). This restraining ring comprises a plurality clamping screws (11) evenly distributed over the circumference, which engage a bell end rim (32), and which permit

adjusting the axial position of the restraining ring (9) relative the bell end, while changing the degree of the bias exerted on the clamping ring (14) and/or joint gasket (8).

ANTISHEAR BELL AND SPIGOT JOINT MECHANISM

The invention relates to an antishear bell and spigot joint mechanism, in particular for socket pipes that are produced by the centrifugal casting method, wherein the spigot end of the one pipe is adapted for insertion with a radial play into the bell end of the other pipe, which includes a clamping ring that is separated from the joint gasket. This clamping ring consists of a plurality of clamping segments that are arranged in spaced relationship in the circumferential direction. The clamping segments comprise a spherically shaped outside surface. They are interconnected in the circumferential direction by molded-on intermediate layers of rubber or the like. Each clamping segment includes on its inside surface an arrangement of teeth, which radially press against the spigot end, when axial forces occur as a result of the interaction of the spherical outside surface with an inside surface that conically tapers toward the outer end.

In a known bell and spigot joint mechanism of this type (DE-OS 36 07 231), the bell end of the pipes being joined includes in axially offset relationship and separated by a support shoulder, a sealing chamber for accommodating the joint gasket and a locking chamber for receiving the clamping ring. The locking chamber is

bounded by an inside surface of the pipe socket that tapers toward the bell end. The use of such a bell and spigot joint thus necessitates a very special configuration of the pipe socket that is adapted to the dimensions of the joint gasket on the one hand and the clamping ring on the other hand.

At this point, it should be remarked that an arrangement for restraining tension and shear in screw socket joints is also known (DE-OS 34 19 633), which uses for radially biasing the clamping ring a compression ring with an external screw thread that engages a corresponding internal screw thread at the bell end. Likewise, this arrangement for restraining tension and shear in screw socket joints necessitates in a costly manner a special configuration.

It is an object of the invention to further develop the known bell and spigot joint mechanism such that it is also possible to use a socket pipe with a bell end of a comparatively simple configuration for forming a bell and spigot joint.

The bell and spigot joint mechanism of the present invention, which accomplishes this object, is essentially characterized in that the bell end is provided for receiving the joint gasket with an axially open sealing chamber, which is formed by radially widening the diameter of the inside socket wall; that a restraining ring is associated to the bell end, which is used for securing a clamping ring and compressing the joint gasket, which comprises the inside surface that conically tapers toward the outer end, and which is contacted by spherically shaped outside surfaces of the clamping segments associated to the clamping ring; and that the restraining ring comprises a

plurality of clamping screws evenly distributed over the circumference, which engage the bell end and permit adjusting the axial position of the restraining ring relative to the bell end while changing the degree of the bias exerted on the clamping ring and/or joint gasket.

This embodiment is connected with the essential advantage that despite the use of normal socket pipes without a special socket configuration, it permits producing in a simple manner a rigid, antishear, and tight connection of successive pipes.

With respect to a perfect sealing, it has been found especially advantageous, when the restraining ring includes on its side facing away from the outer end a cylindrical, annular projection that supports itself on the joint gasket with a face end transverse to the ring axis.

In a modified, simpler embodiment, which does not require the cylindrical annular projection of the restraining ring, the clamping ring that is biased by the restraining ring supports itself on the joint gasket in the axial direction. In this connection, it has been found very useful to place a sliding ring between the clamping ring and the joint gasket.

To ensure a satisfactory positioning of the clamping ring with its clamping segments relative to the conical inside surface of the restraining ring or the outside surface of the spigot end, it has been found advantageous to mold to the clamping ring, a retaining member of an elastomer that can be secured to the restraining ring, and which supports it. In a state secured to the face end of the restraining ring, this retaining member keeps the clamping ring in a position close to the face end of the restraining ring, from which

it is more or less axially displaced as a function of dimensional tolerances, when the spigot end of the other pipe is inserted. However, during an insertion, the clamping ring immediately comes with its clamping segments into an operative contact with the conical inside surface of the restraining ring on the one hand, and via the toothing with the outside surface of the spigot end on the other hand, and it remains in this position, until a first pressure is applied to the pipes. The clamping ring will then immediately satisfy its required clamping function without any noticeable delay.

With respect to a simple and reliable handling, it has been found especially advantageous, when the outer end of the conical inside surface of the restraining ring, which is contacted by the spherically shaped outside surfaces of the clamping segments of the clamping ring, is followed by an end face that extends transversely to the axis of the restraining ring and merges into an approximately cylindrical outer side, and when the retaining member that is formed by a collar, comprises an annular-cylindrical section that contacts the cylindrical outer side of the restraining ring, an annular disk-shaped section adjacent thereto and contacting the end face of the restraining ring, as well as a connecting section that extends from the inner rim of the restraining ring end face toward the clamping ring, and which is adapted for widening together with the clamping ring as a function of the outside dimensions of the spigot end being inserted and, in so doing, for extending in the axial direction. It is easy to secure the thus-formed collar to the face end of the restraining ring by sliding it thereover. Furthermore the connecting section enables a centric insertion of the

spigot end. In so doing, the section widens to an extent necessary for guiding the spigot end toward and into the clamping ring that directly follows the connecting section and widens to the same extent. As soon as the clamping segments come into contact with the conical inside surface of the restraining ring end, they automatically ensure in an especially advantageous manner a centering of the pipe because of a simultaneous, forced contact with the outside wall of the inserted spigot end.

In a further embodiment, a mechanism has been found advantageous, in which a cover is molded to the collar that prevents foreign bodies or impurities from entering the interior of the pipe, after securing the restraining ring to the pipe socket. The use of such a cover will be extremely useful, when laying pipes with inside cementing, since pipes cemented on the inside cause serious cleaning problems in the case of soiling.

The cover in question may be made very simple, namely in the form of a flat, elastic diaphragm.

To ensure an adequate stability of the restraining ring in a loaded state, i.e., after its installation on the pipe socket, it has been found advantageous to provide it with axis-parallel bores that are evenly distributed over the circumference for accommodating clamping screws, as well as with an annular collar that extends in spaced relationship from and over the end face of the bell end and imparts flexural strength. In this connection, it has been found useful to provide the restraining ring with radial projections that are molded to the circumference, and which contain bores for the clamping screws.

When securing the restraining ring to the pipe socket, a very practical handling will be ensured, when each clamping screw terminates at its one end in a screw thread for receiving a clamping nut, and at its other end in a transversely projecting retaining nose, which backs up a radially projecting socket rim of the socket pipe.

Further details, advantages, and characteristics will become apparent from the following description and the drawing, which is herewith expressly incorporated by reference with respect to the disclosure of all details not included in the description. In the drawing:

Figure 1 is an axially sectioned view of the spigot end of a pipe with a bell end of an adjoining pipe slipped thereover and a restraining ring associated thereto;

Figure 2 is an axially sectioned view corresponding to the view of Figure 1 for illustrating a modified embodiment; and

Figure 3 is an axially sectioned view likewise corresponding to Figure 1 for illustrating a further modified embodiment.

A shown in the drawing, each socket pipe **1** that is provided on the inside with a cement mortar coating, comprises at its end, the bell end **2**, a socket, which is adapted for receiving with a radial play a spigot end **3** of an adjacent socket pipe **1**. The interior of the socket accommodates a recess **4**, which permits a relative swing of the pipes **1** within certain limits. This recess connects in a usual manner to a chamber **5**, which is outwardly defined in the axial direction by a radially extending inside shoulder **6** of the bell end **2**. Starting from the inside shoulder **6**, the bell end **2** is provided with an axially open

sealing chamber 7, which is formed by radially widening the diameter of the inside socket wall. This sealing chamber serves to secure the position of a joint gasket 8 of a relatively soft elastomeric material. Associated to the bell end 2 is a restraining ring 9, which comprises several, preferably three or four axis parallel bores 10 that are evenly distributed over the circumference for receiving clamping screws 11, as well as an annular collar 12 that extends in spaced relationship from and over the end face of the bell end 2 and imparts a flexural strength. On its opening side facing the spigot end 3 of the adjacent pipe 1, the restraining ring 9 includes an inside surface 13 that conically tapers toward the outer end and comes into contact with a clamping ring 14. This clamping ring 14 comprises several, for example, four clamping segments 15 that are arranged in spaced relationship in the circumferential direction. These clamping segments 15 are interconnected in the circumferential direction, each by a molded-on intermediate layer of rubber or the like, which is not shown in greater detail. On their side facing the inside surface 13, each clamping segment 15 comprises a spherically shaped outside surface 16. Upon occurrence of axial forces, the inside surface 13 presses a toothing 17 provided on the inside surface of each clamping segment 15 in the radial direction against the spigot end 3.

As shown in the drawing, the clamping ring 14 mounts a collar 18 of an elastomer, which is adapted for being secured to the restraining ring 9 and for supporting it. This collar 18 comprises an annular-cylindrical section 20 that comes into contact with a cylindrical outer side 19 of the restraining ring 9, an adjacent annular disk-shaped section 22 that comes into contact with an end

face **21** of the restraining ring, as well as a connecting section **23** that extends from the inner rim of the restraining ring end face toward the clamping ring **14**. This connecting section can be widened together with the clamping ring **14** and, in so doing, be extended in the axial direction as a function of the outside dimensions of the spigot end **3** being inserted.

As further shown in the drawing, in the installed state of the restraining ring **9**, the collar **18** mounts a cover **24** shown in phantom lines, which protects the pipe interior against the entry of foreign bodies or impurities. In the illustrated embodiment, the cover **24** is made in the form of a flat, elastic diaphragm. However, it may also be constructed in the form of a bag. As also indicated in the drawing, a predetermined breaking point or perforation **25** is provided in the region of the collar **18**, which makes it possible to tear off or cut out the cover **24** with ease directly before the assembly. In this manner, it is effectively avoided that the interiors of the pipe and fittings are soiled during their transportation and on the construction site.

As shown in Figure 1, the clamping ring **14**, which is biased by the restraining ring **9** is axially supported on the joint gasket **8** via an interposed sliding ring **26**.

In the modified embodiment of Figure 3, the joint gasket **8** is biased in a corresponding manner, starting from the conically tapering inside surface **13** of the restraining ring **9** via the sliding ring **26**. However, this embodiment does without the cover **24** of Figure 1, and is constructed in a correspondingly simplified manner.

The embodiment of Figure 2 differs from that of Figure 1 by an annular cylindrical projection **27** on the

side of the restraining ring **9** that faces away from the outer end. This annular projection is supported on the join gasket **8** with an end face **28** that extends transversely to the ring axis. This embodiment has been found more advantageous than those of Figures 1 and 3, inasmuch as it permits metering with greater ease the degree of the bias that is exerted on the joint gasket.

Common to all embodiments is the way of securing the restraining ring **9** to the bell end **2** of a socket pipe **1**. All clamping screws **11** comprise in like manner at their one end a screw thread for receiving a clamping nut **30**, and at their other end a transversely projecting retaining nose **31**, which backs up a radially projecting rim **32** of the socket pipe **1**. Furthermore, the restraining ring **9** comprises molded-on projections **33**, through which bores **10** extend for receiving the clamping screws **11**.

C L A I M S

1. Antishear bell and spigot joint mechanism, in particular for socket pipes (1) produced by the centrifugal casting method, wherein a spigot end (3) of the one pipe is adapted for insertion with a radial play into a bell end (2) of the other pipe that includes a joint gasket (8), to which a clamping ring (14) separated from the joint gasket is associated, with the clamping ring comprising a plurality of clamping segments (15) arranged in spaced relationship in the circumferential direction, with each clamping segment having a spherically shaped outside surface (16), and the clamping segments being interconnected in the circumferential direction by molded-on intermediate layers of rubber or the like, and including

on their inside surface a toothing (17), which radially presses against the spigot end (3) upon occurrence of axial forces by the interaction of the spherical outside surface (16) with an inside surface (13) that conically tapers toward the outer end, **characterized in**

that the bell end (2) is provided with an axially open sealing chamber (7) for the joint gasket (8), with the sealing chamber being formed by a radial diameter widening of the inside wall of the socket;

that the bell end (2) is associated with a restraining ring (9) that is used for retaining the clamping ring (14) and compressing the joint gasket (8), and which comprises the inside surface (13) that conically tapers toward the outer end, and which is contacted by the spherically shaped outside surfaces (16) of the clamping segments (15) associated with the clamping ring (14); and

that the restraining ring (9) is provided with a plurality of clamping screws (11) evenly distributed over the circumference, which engage a socket end (32), and which are used for adjusting the axial position of the restraining ring (9) with respect to the bell end (2), while changing the degree of the bias that is exerted on the clamping ring (14) and/or the joint gasket (8).

2. Mechanism of claim 1, characterized in that the restraining ring (9) comprises on its side facing away from the outer end a cylindrical annular projection (27), which supports itself on the joint gasket (8) with its end face (28) that extends transversely to the ring axis.

3. Mechanism of claim 1, characterized in that the clamping ring (14), which is biased by the restraining

ring (9), supports itself in the axial direction on the joint gasket (8).

4. Mechanism of claim 1 or 3, characterized in that the clamping ring (14) supports itself on the joint gasket (8) via an interposed sliding ring (26).

5. Mechanism of one of claims 1-4, characterized in that the clamping ring (14) mounts a retaining member (18) of an elastomer, which is adapted for being secured to the restraining ring (9) and for supporting it.

6. Mechanism of claim 5, characterized in that an end face (21) transverse of the restraining ring axis adjoins the outer end of the conical inside surface (13) of the restraining ring (9), which is contacted by the spherically shaped outside surfaces (16) of the clamping segments (15) associated with the clamping ring (14), with the end face (21) merging into an approximately cylindrical outer side (19), and that the retaining member formed by a collar (18) comprises an annular-cylindrical section (20), which comes into contact with the cylindrical outer side (19) of the restraining ring (9), an adjacent annular disk-shaped section (22), which comes into contact with the end face (21) of the restraining ring, as well as a connecting section (23), which extends from the inner rim of the restraining ring end face toward the clamping ring (14), and which is adapted for expanding together with the clamping ring (14) as a function of the outside dimensions of the spigot end (3) being inserted and, in so doing, for extending in the axial direction.

7. Mechanism of claim 5 or 6, characterized in that a cover is molded to the collar (18), which protects the pipe interior against the entry of foreign bodies or impurities after mounting the restraining ring (9) to the pipe socket.

8. Mechanism of claim 7, characterized in that the cover (24) is made in the form of a flat, elastic diaphragm.

9. Mechanism of one of claims 6-8, characterized in that a predetermined breaking point or perforation (25) is provided in the region of the collar (18) for facilitating an easy removal of the cover by tearing.

10. Mechanism of one of claim 1-9, characterized in that the restraining ring (9) comprises in evenly distributed relationship over the circumference, axis parallel bores (10) for receiving the clamping screws (11), as well as an annular collar (12) that extends in spaced relationship from and over the end face of the bell end (2) and imparts a flexural strength.

11. Mechanism of claim 10, characterized in that the restraining ring (9) includes circumferentially molded-on radial projections (33), through which the bores (10) extend for receiving the clamping screws (11).

12. Mechanism of claim 10 or 11, characterized in that each clamping screw (11) terminates at its one end

in a screw thread (29) for receiving a clamping nut (30), and at its other end in a transversely projecting retaining nose (31), which backs up a radially projecting socket rim (32) of the socket pipe.